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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/527,347	03/10/2005	Derek John Fray	R & G-106	7234

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EXAMINER	
SALZMAN, KOURTNEY R	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/527,347	FRAY ET AL.	
	Examiner	Art Unit	
	KOURTNEY R. SALZMAN	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 September 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21,27 and 28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21, 27 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Summary

1. This application is the national phase application for PCT/GB03/03967 filed September 12, 2003. It claims priority to United Kingdom document 0221393.2 filed September 14, 2002.

Response to Amendment

2. The amendment filed September 17, 2008 has been entered.

3. The 35 USC 112 rejection of claims 15 and 16 is withdrawn in light of the Applicant's amendment to claim 15.

4. Claims 1-21, 27 and 28 are currently pending and have been fully considered.

Claim Rejections - 35 USC § 102

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1, 8-12, 17, 19, 21 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by TIWARI (US 4,882,032).

Regarding claim 1, TIWARI teaches an electrochemical sensor for hydrogen content detection comprising a solid electrolyte (as described in the abstract and column 1, lines 63-67) and a counterelectrode metal hydride reference standard (as discussed in column 1, lines 58-63). The reference standard is a calcium hydride which is packed into a cavity 10 to seal and self contain the hydride within, as discussed in column 2, lines 50-56. In the second limitation of claim 1, because TIWARI disclosed a fully functioning sensor (see fig. 3 and 4), the

content or spatial distribution of oxygen in TIWARI is such that the solid electrolyte is substantially chemically stable giving the claim language its broadest reasonable interpretation. With respect to the oxygen level being "predetermined", whether or not the oxygen level is known or not does not further define the apparatus unless the claim explicitly defines a level of oxygen in question. In addition, it is unclear even to what extent the oxygen content or distribution of the present invention is “predetermined” as the examiner sees no evidence that the applicant actually measured the oxygen concentration levels of its metal/hydrogen reference standard. The only thing relating to a predetermined level of oxygen was the known oxygen content of one of the starting materials (but not the other materials) prior to the firing of that material at 940 °C in a hydrogen atmosphere (page 13, lines 11-22). It is unclear how the oxygen concentration of one of the starting materials prior to a high temperature firing in a reducing gas correlates to a predetermined knowledge of the oxygen concentration of the final metal/hydrogen reference standard. Moreover, if this is the standard for what constitutes predetermined oxygen concentration, because most metal manufacturers will presumably report impurity concentrations of its metal, including the concentration of oxygen, then the oxygen content or distribution in TIWARI would also have thereby been “predetermined” by simply looking at the material data sheet for its purchased metal. Again, in the absence of a particular set forth level of oxygen that differentiates the present invention

from the prior art, the oxygen content or distribution limitations cannot define a difference over the teaching of TIWARI

Regarding claims 8-10, when heated the calcium and calcium hydride of the reference standard will react with any oxygen present at the interface between the electrolyte and electrode, forming various oxide layers at the surface.

Regarding claims 11 and 12, TIWARI discloses a metal coating surrounding the hydrogen electrode in column 2, lines 24-29, made of platinum (claim 12 of the instant application).

Regarding claim 17, TIWARI teaches the packing of calcium and calcium hydride in column 2, lines 50-52. When exposed to the hydrogen, though the electrolyte, from the aluminum melt and the heat from the sensor being submerged in the metal, the calcium placed in the sealed cavity will form a metal hydrogen material used in the reference electrode.

Regarding claim 19, TIWARI teaches the preparation of the reference electrode to occur at the time when the probe is first placed within the melt in column 3, lines 18-22. At this time, limited hydrogen will be present in the probe and a high temperature will be present, as aluminum melts at nearly 660 degrees Celsius.

The gas will inherently have some level of humidity and the claim does not stipulate the level of humidity required.

Regarding claim 21, TIWARI teaches an electrochemical sensor for hydrogen content detection comprising a solid electrolyte (as described in the abstract and column 1, lines 63-67) and a counterelectrode metal hydride reference standard (as discussed in column 1, lines 58-63). The reference standard is a calcium hydride which is packed into a cavity 10 to seal and self contain the hydride within, as discussed in column 2, lines 50-56. In the second limitation of claim 1, TIWARI teaches the counter electrode to provide a predetermined reference hydrogen partial pressure, which indicates a predetermined spatial distribution of oxygen would be required to be known. The successful functioning of the sensor is sufficient and indicates that the electrolyte must be chemically stable or the sensor would be ineffective. The voltage is measured via voltmeter 46 of figure 1, as described in column 3, lines 31-34. The electrolyte 12 of figure 1 contacts the hydrogen via the membrane 14.

Regarding claim 27, TIWARI teaches the electrode to function in an aluminum melt. Aluminum is known to melt around 650-660 degrees Celsius, causing the operating temperature to be around this level after conditioning, as discussed in column 3, lines 20-30.

Claim Rejections - 35 USC § 103

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 2, 3, 13 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032), in view of KIODE et al (US 5,445,725).

TIWARI teaches all the limitations of claim 1 including a proton conducting electrolyte which allows the passage of hydrogen ions.

TIWARI fails to teach a proton conductive material made of a perovskite.

Regarding claims 2, 3 and 28, KIODE et al discloses the use of a proton conducting doped strontium cerate and calcium zirconate as the perovskite structured proton conductive solid electrolyte in the hydrogen sensor, in the column 6, lines 13-16. This membrane is specifically referred to as a "perovskite", as required by claim 2.

At the time of invention, it would have been obvious to one of ordinary skill in the art to use the doped strontium proton conductor as disclosed in KOIDE et al as the proton conductor of TIWARI because the substitution of one known proton conductor for another yields a predictable result, as it is used for the same purpose in both sensors.

Regarding claim 13, TIWARI doesn't teach the specific material used to create the cavity discussed for packing the counter reference electrode. KOIDE et al discloses the use of a glass sealing material for use to keep the reference electrode sensor gas tight as disclosed in column 6, lines 53-57.

9. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032), in view of ALBERTI et al (US 5,453,172).

TIWARI teaches the use of a calcium hydride reference standard.

TIWARI et al fails to teach the reference standard comprising titanium, zirconium or hafnium.

Regarding claim 4, ALBERTI et al teaches a sensor for determining a concentration of hydrogen gas (abstract) comprising a protonic solid electrolyte, reference number 1, and a solid state reference electrode, containing metal and hydrogen (titanium hydride), reference number 3, in figure 1, shown to be in contact.

At the time of the invention, it would have been obvious to substitute the titanium hydride electrode of ALBERTI et al, for the calcium hydride electrode of ALBERTI et al because they both function as a reference electrode, therefore their substitution would yield predictable results.

10. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032) and ALBERTI et al (US 5,453,172), as evidenced by WETCH et al (US 4,127,443).

TIWARI teaches all the limitations of claim 1. TIWARI et al fails to teach the reference standard comprising titanium, zirconium or hafnium. TIWARI teaches the operation of the electrode in an aluminum melt, which is known to melt around 650 degrees Celsius.

ALBERTI et al teaches a sensor for determining a concentration of hydrogen gas (abstract) comprising a protonic solid electrolyte, reference number 1, and a solid state reference electrode, containing metal and hydrogen (titanium hydride), reference number 3, in figure 1, shown to be in contact.

At the time of the invention, it would have been obvious to substitute the titanium hydride electrode of ALBERTI et al, for the calcium hydride electrode of ALBERTI et al because they both function as a reference electrode, therefore their substitution would yield predictable results. ALBERTI et al also teaches the use of different phases, or α-phase zirconium hydrogen layers, in the sensor. (Claim 1) TIWARI and ALBERTI et al fail to explicitly teach the presence of the two states in the metal hydrogen standard.

Treatment of the electrode material of zirconium hydride at 650 ° C according to the phase diagram present as figure 4 of WETCH et al can be found to cause α and β zirconium hydride or β and δ zirconium hydride to be present. The manipulation of the atom percent or atomic ratios at this temperature can cause, without undue experimentation, the formulation of either phase set. Nearly all atomic ratio or atom percent of hydrogen, at 650 ° C, will cause the formation of a two-phase reference, making it obvious to that at the operating conditions disclosed in TIWARI, the electrode of ALBERTI et al will be present in two phases, evidenced by WETCH et al.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032) and KOIDE et al (US 5,445,725) as applied to claim 13 above, as evidenced by FERRO ("Electronic and Specialty Glass: Low Temperature Sealing." Ferro Corporation. 2008. 11 Apr. 2008 <http://www.ferro.com/our+products/electronic/products+and+markets/electronic+and+specialty+glass/low-temperature+sealing.htm>.)

KOIDE et al teaches the use of a glass sealant to create the air-tight sensor of TIWARI and discloses all the necessary elements of claims 1 and 13.

The combination of KOIDE et al and TIWARI does not teach the use of a specific type of glass.

There are a very large number of low temperature sealant products evidenced by the Ferro Corporation extensive list shown including product EG 2759 which is used with glass substrates like that of the sensor tubing. This sealant, as shown in the information regarding the product, functions as a glass sealant containing no silicon and borate, a boron oxide, with a low temperature. These types of sealants are very common in the industry and is just one example of those offered by one company.

At the time of invention, it would be obvious to use the sealant of the FERRO company as a substitute for the glass sealant used in the combination of KOIDE et al and TIWARI because the simple substitution of materials which function the same way would create a predictable result.

12. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032) and KOIDE et al (US 5,445,725) as applied to claim 13 above, and further in view of BODE (US 4,174,258).

KOIDE et al teaches the use of a glass sealant to create the air-tight sensor of TIWARI and discloses all the necessary elements of claims 1 and 13.

The combination of KOIDE et al and TIWARI does not teach the use of a protective film, or inert packing, within the sensor.

BODE teaches an electrolyte gas sensor which uses a protective means 13. Figure 2 shows the protective means to fill the balance of the sensor. BODE teaches the protective material to contain oxide metals including that of yttrium. (c. 4, l. 4-19) BODE shows the protective member to be a liner or located inside the sensor chamber, therefore between the inside or electrode member of ALBERTI et al and the sealant disclosed on the outside of the electrode of KOIDE et al.

At the time of invention, it would be obvious to fill the sensor chamber, as disclosed in BODE, in the sensor as disclosed by TIWARI and KOIDE et al because the material is used to maintain a constant partial pressure of gas within the sensor chamber (c. 4, l. 1-3), just as is required by an effective reference electrode through constant partial pressure.

13. Claims 7, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIWARI (US 4,882,032).

Regarding claim 7, since the calcuim hydride material used in TIWARI is used as both the electrolyte and the reference electrode, there will inherently be minimal reactivity. Therefore, the bulk oxygen content can be any concentration and still sufficiently prevent reactivity.

Regarding claim 18, in light of the rejection of claim 17, it would be obvious the material would be heated to seal the cavity. Therefore, it would have been

obvious for the hydride material and metal material present to be exposed to hydrogen from the electrolyte as the reference compartment is sealed overall within the housing 4.

Regarding claim 20, in light of the rejection of claim 19 above. the melting temperature of aluminum is 660 degrees Celsius rendering obvious the temperature of 700 degrees indicated in the claim. The time required to precondition the electrode of TIWARI is not indicated however, it would have been obvious to leave the electrode to condition for however long is necessary for the electrode to reach the criteria in column 3, lines 18-30. If less than 15 minutes are needed for the sensor to reach a steady partial pressure, it would have been obvious to leave the electrode to sit longer than the requisite time to ensure an accurate and stable partial pressure of hydrogen.

Response to Arguments

14. Applicant's arguments, see page 7 as the limitation discussed sealing is discussed, filed September 17, 2008, with respect to the rejection(s) of claim(s) 1 under 35 USC 102 and 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of TIWARI, in combination with reference KIODE et al, FERRO, WETCH, BODE and ALBERTI.

15. Applicant argues on numerous pages of the remarks that the previous rejection in view of ALBERTI et al failed to show the predetermined "content and/or the spatial distribution of oxygen".

a. While the application of this argument to ALBERTI is moot in view of the new rejection it would still be deemed relevant to discuss the argument in general. The specification shows the only known concentration of oxygen being included in the reference standard is the oxygen concentration of the wire. This disregards other unknown quantities of oxygen and does not yield a predetermined value as is required claimed in claim 1. Since there are other unknown quantities of oxygen also present that are not discussed, that also allows for the reference applied to also have a “predetermined… oxygen content” which doesn’t account for all sources.

16. Applicant also argues at length regarding the previous rejection fails to teach the electrolyte to explicitly be stable.

b. While the application of this argument to ALBERTI is moot in view of the new rejection it would still be deemed relevant to discuss the argument in general. A chemically stable electrode is sufficiently interpreted to simply be a functioning electrode, absent clarification from the specification to the contrary.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KOURTNEY R. SALZMAN whose telephone number is

(571)270-5117. The examiner can normally be reached on Monday to Thursday 6:30AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kaj K Olsen/
Primary Examiner, Art Unit 1795

krs
12/18/2008